Roberts Bluff Bridge
Blackwater vicinity
Cooper County
Missouri

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PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Rocky Mountain Regional Office
Department of the Interior
P.O. Box 25278
Denver, Colorado 80225

HISTORIC AMERICAN ENGINEERING RECORD
ROBERTS BLUFF BRIDGE

I. INTRODUCTION

Location:	Spanning the Lamine River 5.5 miles upstream from the mouth of the Blackwater River and 3.5 miles south and 0.5 miles east of the town of Blackwater.
Quadrangle:	Pilot Grove North 7.5 minute series
UTM:	4307880N 501470E Zone 15
Date of Construction:	1904 Main span and north approach span 1905 Additional north approach span
Present Use:	Vehicular Bridge
Significance:	The Roberts Bluff Bridge constructed by A. M. Blodgett of Kansas City, Missouri represents a well preserved example of the rapidly disappearing Parker through truss bridge form in the Midwest region.
Historian:	Craig Sturdevant. Environmental Research Center of Missouri, Inc. 1987.

II. HISTORY

A. EARLY 20TH CENTURY BRIDGE BUILDING IN MISSOURI AND COOPER COUNTY

Metal truss bridge construction in Missouri and the Nation after the Civil War left the railroads, where they were technologically developed, and began replacing fords and wooden bridges on the road system. There has been no inventory of Missouri bridges and numbers of metal truss bridges in terms of type for the period of the present bridge (1900 - 1910) is unknown (Personal Communication: Lee Gilliard). The Roberts Bluff Bridge is an example of a Parker through truss bridge. These forms appear to date somewhat later than the Pratt and Warren types (Comp and Jackson 1977) and appear to be used for longer spans than was the case for the Pratt and Warren bridge types (Personal Communication: Lee Gilliard). While the Parker truss patent appears to have been developed not much later than the Pratt and Warren (Comp and Jackson 1977), the Parker apparently was more effective for longer spans than the Pratt and Warren and was thus used later in time than these other forms when the road system developed to the point that the narrowest existing ford and wooden bridge crossings were not necessary for bridge locations (Personal Communication: Lee Gilliard).

Review of Cooper County court records indicates that the first 20 years of thge 20th century saw the construction of most of the major and minor bridges in the county.

Records of the county clerk's office reveal a system whereby the county court would receive petitions for road and bridge construction. The county road and bridge commission, chaired by the county surveyor, would then prepare a report and proposal for construction to submit to the county court who would in turn seek bids for construction of the proposed structure. Often, although not in the case of the Roberts Bluff Bridge, the court would seek separate bids for main spans, piers, and approaches. In most cases, raw materials such as lumber and rock were supplied by local contractor. Masonry work was also usually provided by local contractors. The county bridge commissioner (county surveyor) would act as an agent of the county court in receiving bids, negotiating contracts, coordinating construction, quality control inspections, and final inspections. The bridge commissioner would prepare periodic reports to the county court recommending partial payments and/or release of bond and final payment to the contractors.

B. CONSTRUCTION CHRONOLOGY

The construction history of the Roberts Bluff Bridge is found in the original documents between A. M. Blodgett of Kansas City, Missouri, a civil engineer, and the Cooper County, Missouri court and its representatives. These documents have been preserved in place partially through the efforts of the Cooper County Historic Society. As well as providing historic data on the bridge, these documents are of interest in and of themselves in that they show Blodgett's use of standardized contract form, plans, and specifications in dealing with county governments. The first documents in chronological order include a simple blueprint of the proposed bridge and a rather impressive set of standardized bridge specifications. The second set of documents includes the report of the road and bridge commissioner to the county court filed March 7, 1904 recommending that A. M. Blodgett's low bid of $3,150.00 be accepted as well as the signed contract (also a standardized A. M. Blodgett form) contracting A. M. Blodgett to a 180 foot span with a 15 foot approach. One end of the bridge was to rest on a natural stone bluff. The bridge was to be completed before August 1, 1904. The Roberts Bluff Bridge ended up necessitating an additional approach which brought the total price of the bridge to $4,028.75 rather than original $3,150.00 and the actual completion date to one year beyond the contracted for date in August 1904.

C. LOCATION

The Roberts Bluff Bridge oriented north and south lies just south of the north section line in the NW NE NE 1/4 of Section 22, Township 48 North, Range 19 West and crosses the Lamine River 5.5 miles upstream from the mouth of the Blackwater River. The bridge is 3.5 miles south and 0.5 miles east of the town of Blackwater.

III. THE BRIDGE

A. DESCRIPTION

The Roberts Bluff Bridge is a four span structure with a 180 foot 10 panel pin connected Parker through truss main span with 14 foot horizontal and 16 foot vertical portals and two northern approach structures. The main span tension and compression members are composed of the following materials: Vertical posts - lattice braced channel iron diagonals, hip verticals, and bottom chords - eye bars, top chords and inclined end posts - lattice braced channel iron with rolled steel rivited to the upper surfaces, latteral, counter, and sway bracing - 1 inch steel rod struts and outer stringers - channel iron floor beams and 6 remaining stringers - I - beams and portal bracing - angle iron with rolled steel reinforcement. The main span deck is rough sawn oak planking. The side rails are 2 inch iron pipe. The south portal retains the bridge plate:

A. M. BLODGETT
KANSAS CITY, MO
1904
A. RANDOLPH PRES. JUDGE
J. A. FISCHER, F. M. SHANNON
ASSOCIATE JUDGES
C. W. NIXON COUNTY CLERK
W. C. ALLISON BRIDGE COMM.

The middle approach structure is a single 64 foot span four panel pin connected Pratt pony truss with eye bar diagonals and bottom chords, latticed channel iron verticals, latticed channel iron top plated inclined end posts and top chords, I beam floor beams, channel iron and I beam stringers, one inch rod bottom lateral bracing, and rough sawn oak plank decking.

The abutment end approach structure is a 40 foot two span platform composed of eight 6 inch l beams and two 6 inch channel iron and one 6 inch oak stringers with a 3.5 foot high 6 panel side rail with a 20 foot bar lattice and a rough sawn oak plank deck.

The main span is supported on the south end by a natural stone bluff and on the north end by two sway braced rivited rolled steel cylinders filled with rock rubble and sharp sand aggragate. The north end of the middle approach structure is supported by a sway braced channel iron pier. The mid section of the north end approach structure is supported by a pier composed of 5 l-beams sway braced with angle iron supporting and I -beam floor beam and resting on an 8 inch by 12 inch by 16 foot buried oak beam. The north end of the structures is set on a rock rubble masonry abutment.

B. MODIFICATIONS

The northern end approach structure pier and abutment was added to the original structure approximately one year after the completion of the bridge. The only other modifications to the original 1904 structure was the replacement of the original pine side rails with 2 inch iron pipe on the main span and middle approach structure.

C. OWNERSHIP AND FUTURE

The Roberts Bluff Bridge has been owned and maintained by Cooper County since its original construction in 1904. It has been determined to be obsolete and insufficient to carry the current and projected traffic and load demands. A replacement structure is planned and the Roberts Bluff Bridge will be demolished or dismantled in 1988.

IV. BIBLIOGRAPHY

Comp, T. Allan and Donald Jackson
1977 Bridge Truss Types: A Guide to Dating and Identifying. American Association for State and Local History Technical Leaflet 95, History News, Volume 32, Number 5, May 1977.

Contract
1904 A. M. Blodgett, Civil Engineer and Bridge Contractor. Enterred into with Cooper County Court for the main span of Roberts Bluff Bridge. March 7, 1904.

Contract
1904 A. M. Blodgett, Civil Engineer and Bridge Contractor. Enterred into with Cooper COunty Court for 54 foot steel span approach.

Letter
1904 From W. Allison, Road & Bridge Commissioner to C. W. Nixon County Clerk, Cooper County. (Recommends A. M. Blodgett's $3,150 bid). March 7, 1904.

Letter
1904 From W. Allison, Road & Bridge Commissioner to C. W. Nixon County Clerk, Cooper County. (Report of work completed on bridge).. December 5, 1904.

Peronal Communication
1988 Lee Gilliard. Bridge Historian. Missouri Department of Natural Resources/Historic Preservation Program. Jefferson City.

A. M. BLODGETT,

BRIDGE CONTRACTOR,

KANSAS CITY, MO.

GENERAL SPECIFICATIONS.

1.—The work comprised in the following specifications is the furnishing of all Materials, Labor, Plant and Implements required for the erection and entire completion of the Superstructure of Bridge over the ...., in the .... and State of

2.—All parts of the structure will be of wrought iron or steel, except the flooring, floor joists and wheel guards.

HEAD-ROOM. 3.—For all through bridges there will be a clear headroom of 14 feet above the floor.

LENGTH OF SPAN. 4.—In calculating strains, the length of span will be understood to be the distance between centers of end pins for trusses, and between centers of bearing plates for all beams and girders.

LOADS. 5.—Thes tructure will be proportioned to carry the following loads:

1st. The weight of all metal in the structure.

2d. The weight of the wooden floor, considering each foot of board measure to weigh 4 pounds for oak and other hard woods, and 3 pounds for all other kinds.

DEAD LOAD. These two items, taken together, will constitute "the dead load."

LIVE LOAD. 6.—Also to sustain the passage of a rolling load of pounds ( ) per square foot of roadway, and pounds ( ) per square foot of sidewalk, and will not deflect under the passage of such a load more than one twelve-hundredth of its length and return to its original camber.

WIND BRACING. 7.—The Lateral Bracing will be proportioned to resist wind pressure as follows: Laterals on unloaded chord, one hundred and fifty pounds (150) per lineal foot; Laterals on loaded chord, three hundred pounds (300) per lineal foot; 150 pounds of this to be treated as a moving load.

TEMPERATURE. 8.—Variations in temperature, to the extent of 150 degrees, will be provided for.

All parts will be so designed that the strains coming upon them can be accurately calculated.

PROPORTION OF PARTS.

TENSILE STRAINS. 9.—All parts of the structure will be proportioned in tension by the following allowed unit strains:

	Iron.	Steel.
On Lower Chords, main diagonals (forged eye bars)	12,500	15,000
Lower Chords (plates and shapes) net section	10,000	12,000
Counters and Hip Verticals	10,000	12,000
Hip Verticals (plates and shapes) net section	9,000	10,800
Beam Hangers (loops)	9,000	......
Beam Hangers (plates)	7,500	9,000
Laterals and Vibration Rods	15,000	......
Flanges of Rolled Beams	12,000	16,000
Flanges of Built Beams (net section)	12,000	16,000

NET SECTION. 10.—In members subject to tensile strains full allowance will be made for reduction of section by rivet holes, screw threads, etc.

COMPRESSIVE STRAINS. 11.—Compression members will be proportioned so that the strain per square inch will not exceed that found by the following formula:

$$P = \frac{10,000}{1 + \frac{(12l)^2}{c\, r^2}}$$

in which c = 36,000 for square ends, 24,000 for pin and square ends, and 18,000 for pin ends. P = the allowed compression per square inch of effective cross section, l = length of column in feet; r = least radius of gyration in inches.

STRUTS. 12.—The lateral struts will be proportioned to resist the resultant due to an assumed initial strain of 10,000 pounds per square inch upon all the rods attaching to them, assumed to be produced by adjusting the bridge.

COMBINED STRAINS. 13.—Members subject to alternate strains of tension and compression will be proportioned to resist each kind of strain.

RIVETS, BOLTS AND PINS. 14.—The rivets and bolts connecting the parts of any member will be so spaced that the shearing strain per square inch will not exceed 9,000 pounds; nor the pressure upon the bearing surface per square inch of the projected semi-intrados (diameter × thickness of piece) of the rivet or bolt hole exceed 15,000 pounds. For rivets driven in the field, provision will be made twenty-five (25) per cent. in excess of above requirements.

DETAILS OF CONSTRUCTION.

DETAILS. 15.—All the connections and details of the several parts of the structure will be of such strength that ruptures will occur in the body of the members rather than in any of their details or connections.

WEB SPLICES. 16.—The webs of plate girders will be spliced at all joints by a plate on each side of the web.

STIFFENERS. 17.—All web plates will have stiffeners over bearing points and at points of local concentrated loadings.

RIVETING. 18.—The pitch of rivets in all classes of work will never exceed 6 inches, or sixteen times the thinnest outside plate, nor less than three diameters of the rivet.

19.—The distance between edge of any piece and the centre of a rivet hole will never be less than 1¼ inches, except for lacing bars; when practicable it will be at least two diameters of the rivet.

20.—Wherever possible, all rivets will be machine driven, and when driven will completely fill the holes. Field riveting will be reduced to a minimum or entirely avoided where possible.

21.—The several pieces forming one built member will fit closely together, and when riveted will be free from twists, bends or open joints.

ABUTTING JOINTS. 22.—In compression members, abutting joints with planed faces will be sufficiently spliced to maintain the parts accurately in contact against all tendencies to displacement.

EYE-BARS. 23.—The heads of eye-bars will be so proportioned and made, that the bars will preferably break in the body of the bar than at any part of the head or neck.

24.—The pin holes will be in the center of the head, and on the center line of the bar, and will not be more than $\frac{1}{32}$ inch larger than the diameter of the pin.

25.—The lower chord will be packed as narrow as possible, and the bars arranged so as to produce the least bending moment on the pin.

UPSET ENDS. 26.—All rods and hangers with screw ends will be upset at the ends.

27.—Bent loops will fit perfectly around the pin throughout its semi-circumference.

COMPRESSION MEMBERS. 28.—Compression members will be of wrought iron or steel.

29.—The pitch of rivets at the ends of compression members will not exceed four diameter of the rivets for a length equal to twice the width of the member.

30.—The open sides of all compression members will be stayed by batten plates at the ends and diagonal lattice work at intermediate points. The batten plates will be placed as near the ends as practicable, and will have a length equal to the depth of the member. The size and spacing of the lattice bars will be proportioned to the size of the member. They will be inclined at an angle not less than 60° to the axis of the member.

31. Where necessary, pin holes will be reinforced by plates, so the allowed pressure on the pins will not be exceeded. These reinforcing plates will contain enough rivets to transfer their proportion of the bearing pressure.

BED-PLATES. 32. All bed-plates will be of such dimensions that the greatest pressure upon the masonry will not exceed 250 pounds per square inch.

ROLLERS, USED ONLY IN SPANS OVER 75 FT. 33. Roller pressure per lineal inch will not exceed the product of the square root of the diameter of the roller in inches multiplied by 500 pounds (500 √ in.)

WORKMANSHIP 34. All workmanship will be first class in every particular.

35. Whenever necessary for the protection of the thread, provision will be made for the use of pilot nuts in erection.

IRON. 36.—The iron used to be tough, ductile, fibrous and of uniform quality, with an elastic limit of not less than 26,000 pounds per square inch, and an ultimate strength of 50,000 pounds per square inch of sectional area.

STEEL. 37.—The steel used to be of the grade known as soft steel, and will have an ultimate strength of from 54,000 to 62,000 pounds per square inch; elastic limit to be one-half the ultimate strength.

PAINTING. 38. All iron or steel will be thoroughly scraped and painted on all surfaces before leaving the manufactory with one coat of metallic paint and boiled linseed oil, and with a second coat after the structure is erected.

39.—The whole work will be so arranged and designed, that no part can retain moisture.

TIMBER. 40.—All timber will be of good quality, free from windshakes, loose knots, decayed wood, or any defect that would impair its strength or durability.

ERECTION. 41.—The contractor will furnish all staging and false work, will erect and adjust all iron work, and put in place all the flooring, guards, etc., complete and ready for use.

42.—They will also remove all false work, piling and other obstructions or unsightly material produced by their operations.

DIAGRAM OF STRAINS. 43.—Accompanying this will be found a diagram of strains, setting forth the amount of stress on the different members of the truss, and the areas of metal required to resist them in accordance with the standard herein given. Also the size, shape and actual areas which will be used in the structure. If desired other dimensions may be used at the option of the builder, provided they fill the requirements of these specifications.